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Soil hydraulic properties estimate based on numerical analysis of disc infiltrometer three-dimensional infiltration curve

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Measurement of soil hydraulic properties is of paramount importance in fields such as agronomy, hydrology or soil science. Fundamented on the analysis of the Haverkamp et al. (1994) model, the aim of this paper is to explain a technique to estimate the soil hydraulic properties (sorptivity, S, and hydraulic conductivity, K) from the full-time cumulative infiltration curves. The method (NSH) was validated by means of 12 synthetic infiltration curves generated with HYDRUS-3D from known soil hydraulic properties. The K values used to simulate the synthetic curves were compared to those estimated with the proposed method. A procedure to identify and remove the effect of the contact sand layer on the cumulative infiltration curve was also developed. A sensitivity analysis was performed using the water level measurement as uncertainty source. Finally, the procedure was evaluated using different infiltration times and data noise. Since a good correlation between the K used in HYDRUS-3D to model the infiltration curves and those estimated by the NSH method was obtained, (R2 =0.98), it can be concluded that this technique is robust enough to estimate the soil hydraulic conductivity from complete infiltration curves. The numerical procedure to detect and remove the influence of the contact sand layer on the K and S estimates seemed to be robust and efficient. An effect of the curve infiltration noise on the K estimate was observed, which uncertainty increased with increasing noise. Finally, the results showed that infiltration time was an important factor to estimate K. Lower values of K or smaller uncertainty needed longer infiltration times.